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With international search report.
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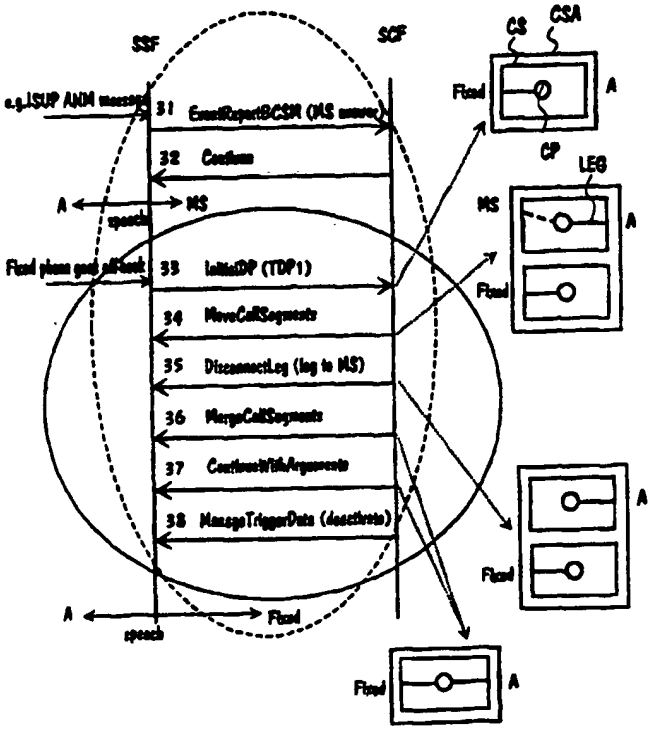
In English translation (filed in Finnish).

(54) Title: IMPLEMENTATION OF CALL FORWARDING IN A TELECOMMUNICATIONS NETWORK

(57) Abstract

A method for forwarding a call in a telecommunications network, where subscriber A's call is transferred using the call forwarding service from subscriber B's first terminal equipment to his/her second terminal equipment, the said second terminal equipment giving an indication of an incoming call. To provide a more user-friendly and less costly service for the user, the system monitors, when forwarding the call, whether the user performs a predefined action while the mobile telephone is ringing, and if such an action is detected, the call is re–routed back to the first terminal equipment. The method is particularly suitable for users who have both a fixed–wire telephone line and a mobile telephone.



Implementation of call forwarding in a telecommunications network

Field of the invention

Generally, the present invention relates to services provided by an intelligent network. More specifically, the invention relates to call forwarding services implemented by means of an intelligent network.

Background

A telecommunications network that includes facilities for providing various services and attributes is called an Intelligent Network (IN). It is an architecture built on the existing telecommunications network, and one of its most important features is its ability to segregate call switching from the service logic. The intelligent network offers the subscriber quick and flexible access to personalised services without any modifications to the software at the exchange. This is possible because the services are controlled by a few centralised control points in the intelligent network specifically designed for this purpose.

Figure 1a shows a simplified example of the structure of the intelligent network. Let us first briefly examine the individual components of the intelligent network and the functions residing in these components.

Subscriber Equipment SE, such as a fixed-wire telephone, mobile station (MS), computer or fax machine, is connected directly to a Service Switching Point SSP.

The service switching point SSP gives the user access to the network, makes the necessary selections and offers the opportunity to use the various services available in the intelligent network. SSP performs two main functions: the Call Control Function CCF and the Service Switching Function SSF. The service switching point SSP identifies the call attempts requesting IN services. At the service switching point, the numbers requiring IN control have been defined in the service trigger table. The service switching point SSP requests instructions for routing the call and performing the service from the IN service control function SCF residing in the service control point SCP. In response, the service control point SCP sends to the service switching point SSP the physical number to which the call is routed. An ordinary call that requires no IN features is connected through the exchange in the normal fashion.

The service control point SCP is a digital exchange or dedicated computer with the necessary software. It contains the service logic, the service control functionality and the service database function. Often, the database is a Service Data Point SDP that is separate from the service control point SCP. The service control point SCP processes the service data in the database by means of its own Service Logic Program LCP and controls the service switching point SSP. Signalling between the service switching point SSP and service control point SCP is carried out via the common channel signalling network SS7 using the INAP protocol.

The service data point SDP contains the data that the service logic programs SLP use to generate personalised services. The service control point SCP can make use of the services offered by the service data point SDP.

The Intelligent Peripheral IP offers specialised services and supports flexible data communications between the user and the network. The intelligent peripheral IP features the Specialised Resource Function SRF that offers an interface to network mechanisms involved in the interaction with the user. Typical examples of such mechanisms are the announcements made to the subscriber and receiving of the subscriber selections.

The various phases of call control are modelled on the ITU-T recommendation Q.1214 by means of the Basic Call State Mode BCSM. Call set-up at the exchange consists of two processes: the originating call set-up (subscriber A) and terminating call set-up (subscriber B), the corresponding state modes being the Originating Basic Call State Mode O_BCSM and the Terminating Basic Call State Mode T_BCSM. The state mode consists of Points In Call PIC, the Detection Point DP and transitions between the various modes. The detection point can serve either as Trigger Detection Points TDP or Event Detection Points EDP. DP1 is also known as a "hot-line-trigger" because it permits IN triggering immediately when the receiver is picked up. The TDP and EDP can be of either the Request or Notification type. If the point is of the Request type, SSP suspends call processing and asks for additional instructions from the SCP, whereas with the Notification type point, the SSP continues call processing normally, but notifies the SCP of point detection, which creates a relationship in which the SCP monitors the SSP.

Figure 1b is a signalling diagram showing the signalling process when a connection is made between subscribers A and B (fixed-wire telephone). The SSP detects that a call is being made to subscriber B that requires IN control, in which case it sends an InitialDP signal to the SCP at point 11. The SCP responds by sending the standard RRBSCME signal at point 12, indicating the detection points to be reported, which are: DP13 meaning that subscriber B's line is busy, DP14 meaning that subscriber B does not answer the call, DP15 meaning that subscriber B answers the call, DP17 meaning that either subscriber A or subscriber B terminates the call, and DP18 meaning that subscriber A gives up before subscriber B answers the call. At point 13, the SCP sends a Continue signal to proceed with the process. In the case used as the example, subscriber B answers the call, which is reported to the SCP by the SSP at point 14 using the EventReportBCSM signal. At point 15, the SCP responds with the Continue signal, as a result of which the call is sustained normally. In other words, a voice connection is set up between subscribers A and B and they can converse with each other.

There is a great variety of intelligent network services available and their number is increasing all the time. Here are a couple of examples of IN services: the Universal Access Number UAN, which makes it possible to call a subscriber using a single number even if he/she has dedicated telephone lines to several sites located in different areas; the Personal Number, which is independent of the network and allows the intelligent network to re-route calls made to the number involved as instructed by the subscriber; and Call Forwarding CF, where the call is transferred to another pre-defined number. The subscriber may activate the call forwarding service, for example from a fixed-wire telephone to a mobile telephone, by keying in a certain code and the mobile telephone number using the keypad of the fixed-wire telephone. Call forwarding is cancelled by keying in a pre-defined cancellation code, similarly using the keypad of the fixed-wire telephone. Call forwarding may be activated from a fixed-wire telephone at home or in the office to a mobile telephone. Once call forwarding has been activated, the fixed-wire telephone will not ring because the exchange has detected that the call forwarding service has been activated and, therefore, sends the call to the mobile telephone. It is possible, however, that the subscriber activating call forwarding is near the fixed-wire telephone (used for activating call

forwarding) when the mobile telephone rings and would rather take the call on the fixed-wire telephone. At present, this is not possible.

Accordingly, the aim of the present invention is to eliminate this drawback and improve the service by making it more user-friendly as well as less expensive.

A brief summary of the invention

The present invention relates to intelligent network services and specifically to call forwarding, where calls are forwarded, for example, from a fixed-wire telephone to a mobile telephone.

The aim of the invention is to provide a solution that improves call forwarding services by making it more user-friendly both in terms of function and cost. This is achieved as described in the independent patent claims.

The idea of the invention is to monitor the subscriber equipment from which calls have been forwarded even after the subscriber unit to which the calls have been forwarded has been notified of the incoming call in order to see whether the user takes some pre-defined action, such as lifting the receiver. If such an action is detected, the call is re-routed to the subscriber unit from which calls have been forwarded. The service based on the invention is particularly convenient for subscribers who have both a fixed-wire line and a mobile telephone. Once the subscriber has activated call forwarding from his fixed-wire telephone to his mobile telephone, he can also take the incoming call on the fixed-wire telephone even if it is not ringing. When call forwarding has been activated and a call is about to be connected to the fixed-wire telephone (subscriber A), the SSP monitors the detection point TDP1 to determine whether the receiver of the fixed-wire telephone (subscriber B) is lifted. The re-routing process is initiated when subscriber B lifts the receiver of the fixed-wire telephone. The service control point SCP controls the call forwarding service by giving processing and routing instructions for the service switching point SSP. More precisely, the SCP activates the said "hot-line" trigger detection point, after which it switches to the monitoring mode to supervise call forwarding, which may be direct or conditional.

The invention makes the call forwarding service less expensive because the subscriber does not have to pay for the leg used for forwarding.

Another advantage offered by the invention is that this can be implemented using the standard Capability Set 2 CS-2 features of the intelligent network.

List of drawings

The following provides a more detailed description of the invention with reference to the examples given in the attached drawings, where

Figure 1a is a diagram showing the structure of an intelligent network,

Figure 1b shows message exchange between the SSP and the SCP during call set-up,

Figure 2 shows communications between the SSP and the SCP related to the call to determine whether the receiver is lifted,

Figure 3 shows another embodiment of the call-related communications between the SSP and the SCP in accordance with the invention using re-routing accordance with the invention.

Detailed description of the invention

Let us examine, by way of an example, a situation where subscriber A wishes to set up a voice connection to the fixed-wire telephone of subscriber B. Subscriber B has activated call forwarding from the fixed-wire telephone to the mobile telephone of subscriber C. In this example, subscriber B and subscriber C are one and the same person. Call set-up between subscriber A and subscriber B is examined by means of the diagram shown in Figure 2, which shows signalling between the service switching function SSF residing in the service control point SCP on the one hand and the service control function SCF residing in the service control point SCP on the other. A call set-up message SETUP arrives from subscriber A to the exchange in the fixed-wire network to which the fixed-wire telephone of subscriber B is connected. When the service switching function SSF of this exchange detects the IN service request (the SSP detects DP12, i.e. a call attempt to subscriber B), it sends, at point 21 in the diagram, the InitialDP message via the signalling network SS7 to the service control function SCF to ask for instructions for routing and processing the call. The first dialogue corresponds to the state mode T_BSCM. The figure provides a presentation of the various phases of the call by means of objects in

accordance with the CS-2 architecture as defined in the ITU-T recommendation 1.224 using the signalling method as in the said recommendation. For each connection, a Call Segment Association CSA is created that contains the Call Segment CS and two objects namely the leg and the Connection Point CP. Viewed from the CSA end, the leg describes the connection path towards the receiving unit while the connection point is the switching location of the legs, allowing the information flow to pass over the individual legs. The state of the leg is shown in the figure in two ways: (1) the dashed line indicates that a signalling connection has been established but that no voice channel has been opened, and (2) the solid line means that a voice connection has been set up. In accordance with the invention the service control function SCF responds to the SSF's request by sending the MangerTriggerData procedure at point 22, which is used, in compliance with CS-2, to activate or trace the TDP state linked to the subscriber's profile. In this case, the message is used to activate TDP1 (monitoring whether subscriber B picks up the receiver or not). If TDP1 is not activated in the SSP (the detection point may be active, for example, because of an earlier intelligent network operation), the detection point TDP1 is activated for subscriber B. The SSP monitors TDP1 and when it detects that subscriber B has picked up the receiver, it immediately sends the InitialDP message to the SCP for potential further action. In accordance with the CS-1 standard, detection points can be activated statically, but CS-2 allows dynamic activation of detection points. At point 23, the SCF sends the operation RequestReportBSCMEvent to the SSF, which indicates to the SSP the detection point that it must report to the SCP. Here, detection point DP15 is activated to detect when subscriber B takes the call and detection point DP17 is activated to detect if subscriber A or subscriber B terminates the call. At point 24, the SCP sends routing instructions for the mobile station to the SSP using the Connect signal.

The following provides a description of signalling in a situation that is identical to the one discussed above except that subscriber B's fixed-wire telephone line is busy. Let us assume that the SSP has sent the InitialDP signal to the SCP as explained at point 21 to receive instructions for processing the incoming call. Then, at point 25, the SCF sends the RequestReportBSCMEvent operation to the SSF, in which it indicates the new detection point to be reported (DP13, 14, 15, 17, 18). The contents of

the detection points are as follows: detection point DP13 indicates that subscriber B's line is busy; detection point DP14 represents the event that subscriber B does not answer the call; DP15 and DP17 serve the same function described in the foregoing paragraph, and detection point DP18 indicates a situation where subscriber A gives up before subscriber B answers. Next, the SCF transmits the Continue operation, requesting that call processing be continued. The SSF responds to the SCF by sending a notification indicating that subscriber B's line is busy using the EventReportBCSM(busy) signal. The signals described in points 28 through 30 are identical to those in points 22 through 24.

The signals contained within ellipse 1 are related to direct call forwarding in the intelligent network and those contained within ellipse 2 to conditional forwarding, the condition in this example being that the receiver's line is busy. Another instance of conditional call forwarding could be a situation where the number does not answer.

The signalling pattern in Figure 3 shows a situation where the call is routed to subscriber C's mobile telephone and subscriber B answers the call that has already been forwarded using the fixed-wire telephone. The corresponding state mode is O_BCSM. For the purposes of this example, it is assumed that TDP1 has been activated as described above. The SSP for subscriber B detects when the mobile telephone answers, at which moment the SSP immediately sends, at point 31, the EventReportBCSM signal to the SCP, which, when detecting that a call connection is being set up, sends, at point 32, the Continue signal to ensure that signal processing is continued. Now, subscriber C has the option of either continuing the call on the mobile telephone or, if close to the fixed-wire telephone used for forwarding the call, taking the call forwarded to the mobile telephone on that particular fixed-wire telephone. To do so, all the subscriber has to do is to pick up the receiver of the fixed-wire telephone because the SSP was previously set to monitor detection point TDP1. Upon detecting that the receiver is lifted, the SSP reports it immediately by sending, at point 33, the InitialDP signal to the SCP. The Call Segment Association CSA, as shown in the figure, is created when the connection is set up. An analysis carried out by the SCP shows that the TDP1 involved is the detection point that was earlier activated and associates the through-call with the call attempt in the same CallSegmentAssociation by sending, at point 34, the MoveCallSegments

signal, informing the SSP that they are inter-related. Additionally, the SCP asks the SSP, at point 35, to disconnect the leg to the mobile telephone by sending the signal DisconnectLeg. At this point, there are two CallSegments "suspended" in the same CallSegmentAssociation, i.e. voice channels have not yet been set up between subscribers A and B. The SCP gives the instructions to inter-connect these voice channels to each other by sending, at point 36, the MergeCallSegments signal. Because the CallSegment contains only one leg, a MoveLeg signal can be used instead of the MergeCallSegment operation to achieve the same effect. After this, the SCP requests the SSP, at point 37, to continue call processing from that point onwards using the ContinueWithArguments signal. At point 38, the SCP sends the ManageTriggerData signal to request deactivation of TDP1 monitoring to ensure that no confusion is created when the receiver is picked up later. The SCP is aware of at which stage of the call TDP1 is deactivated, and this may vary according to the subscriber's wishes. In other words, the subscriber may, when ordering the service, agree with the service provider to select those options that are best suited for him. For example, the following options are available:

TDP1 is deactivated

- when a connection has been set up between subscribers A and B after subscriber C has been alerted
- when a specific period of time t has elapsed since subscriber C has answered the call
- immediately when subscriber C answers the call
- when subscriber A gives up trying to make the call
- when the call from subscriber A to subscriber C has ended
- following satisfaction of some other condition specified by the subscriber.

Such a condition could be an instruction for the SCP to check the number from which the call is coming and compare it with the conditions specified by the subscriber. For example, if the number is one of the numbers for which the subscriber has defined the condition that it must not be routed to his home (work) number, TDP1 will be deactivated.

The dashed-line ellipse in the figure relates to signalling in the event that the mobile telephone answers but the call is continued using the fixed-wire telephone, in which case the connection to the mobile telephone

must be terminated. The solid line ellipse shows a situation where the mobile telephone rings but the call is answered by picking up the receiver of the fixed-wire telephone, by which time no voice channel has yet been set up to the mobile telephone.

Although the invention has been explained with reference to the examples shown in the attached drawings, the invention can naturally be varied within the scope of the idea of the invention presented in the foregoing and the enclosed patent claims. The terminal equipment need not necessarily be telephones and the connection established need not necessarily be a voice connection. Depending on the type of terminal equipment involved, some other operation instead of the lifting of the receiver may be monitored. The operations shown in Figures 2 and 3 can be sent either as separate messages or using a TCAP message that contains one or several operations. The operations need not be performed in the sequence shown. For example, the point when the TDP is activated or deactivated may vary. Moreover, the foregoing example lists only the detection points (DP) that are significant to the example involved, but other detection points can be activated depending on the applicable rules. Furthermore, call forwarding can be implemented by incorporating it in an IN hunting service or some other similar service, depending on the preferred attributes of the total service required. A solution in accordance with the invention is, of course, not limited to a CS-2 standard architecture, but can be implemented using any other standard.

Patent claims

1. A method for call forwarding in a telecommunications network where the call from subscriber A is forwarded, via an intelligent network, from subscriber B's first terminal equipment to other terminal equipment, the said second terminal equipment gives an indication of an incoming call characterized in that when the call is forwarded

- the system monitors whether subscriber B carries out a pre-defined action on the first terminal equipment while the mobile telephone is ringing, and

- if such an action is detected, the call is re-routed to the first terminal equipment.

2. A method in accordance with patent claim 1 characterized in that such a pre-defined action is the activation of the subscriber line, preferably by lifting of the telephone receiver.

3. A method in accordance with patent claim 1 characterized in that monitoring is started by activating, by means of the intelligent network service control function (SCF), the service trigger point TDP1 in the call state mode that the service switching point (SSP) uses to process the call attempt.

4. A method in accordance with patent claim 1 characterized in that monitoring is ended when a connection has been set up between subscriber A and the first terminal equipment of subscriber B after subscriber B's second terminal equipment has given an indication of an incoming call.

5. A method in accordance with patent claim 1 characterized in that monitoring is ended once a specific period of time t has elapsed from the moment when the call is answered on subscriber B's second terminal equipment.

6. A method in accordance with patent claim 1 characterized in that monitoring is ended immediately after the call is answered from subscriber B's second terminal equipment.

7. A method in accordance with patent claim 1 characterized in that monitoring is ended when subscriber A gives up the attempt to set up a connection.

8. A method in accordance with patent claim 1 characterized in that monitoring is ended when the connection set up between subscriber A and subscriber B's second terminal equipment is terminated by either party.

9. A method in accordance with patent claim 1 characterized in that monitoring is ended when a pre-defined condition specified for the calling number is not satisfied.

10. A method in accordance with patent claim 1 characterized in that call forwarding and returning the call to the original number called is implemented using procedures in the accordance with the CS-2 (capability set 2) architecture.

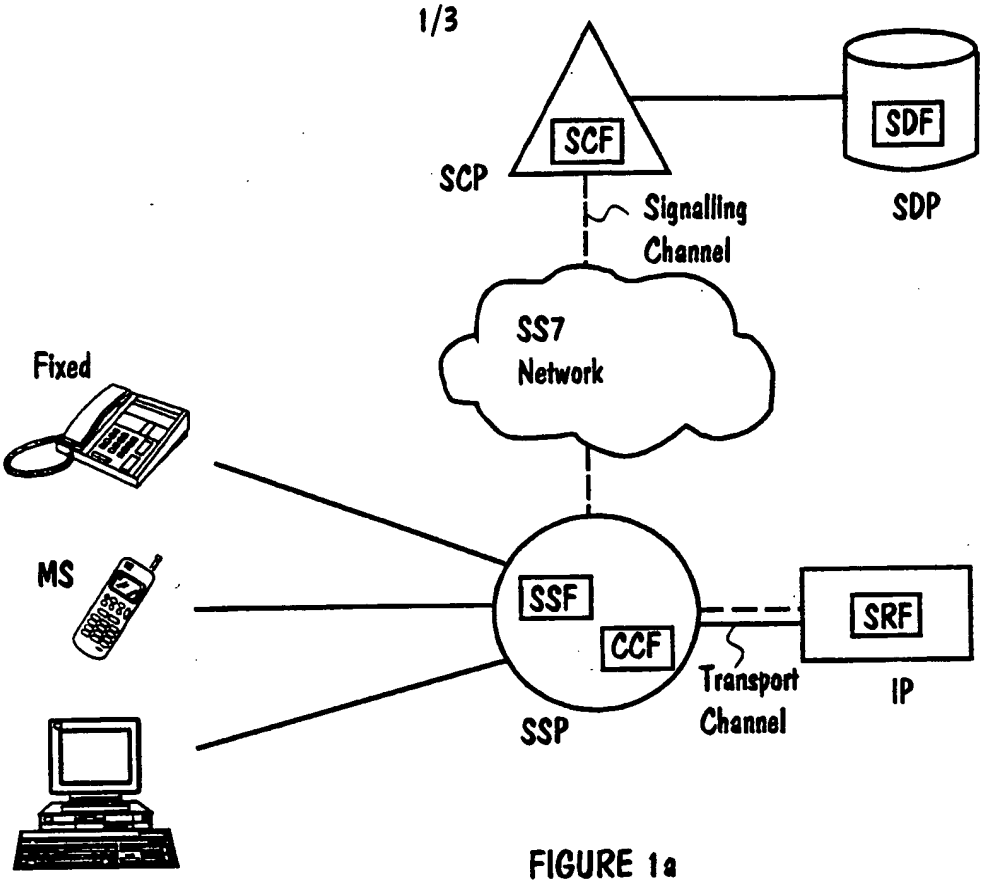


FIGURE 1a

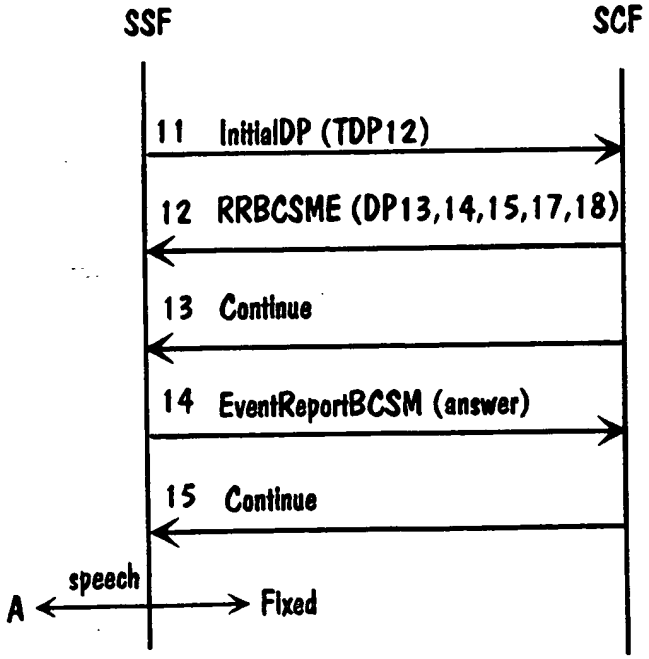


FIGURE 1b

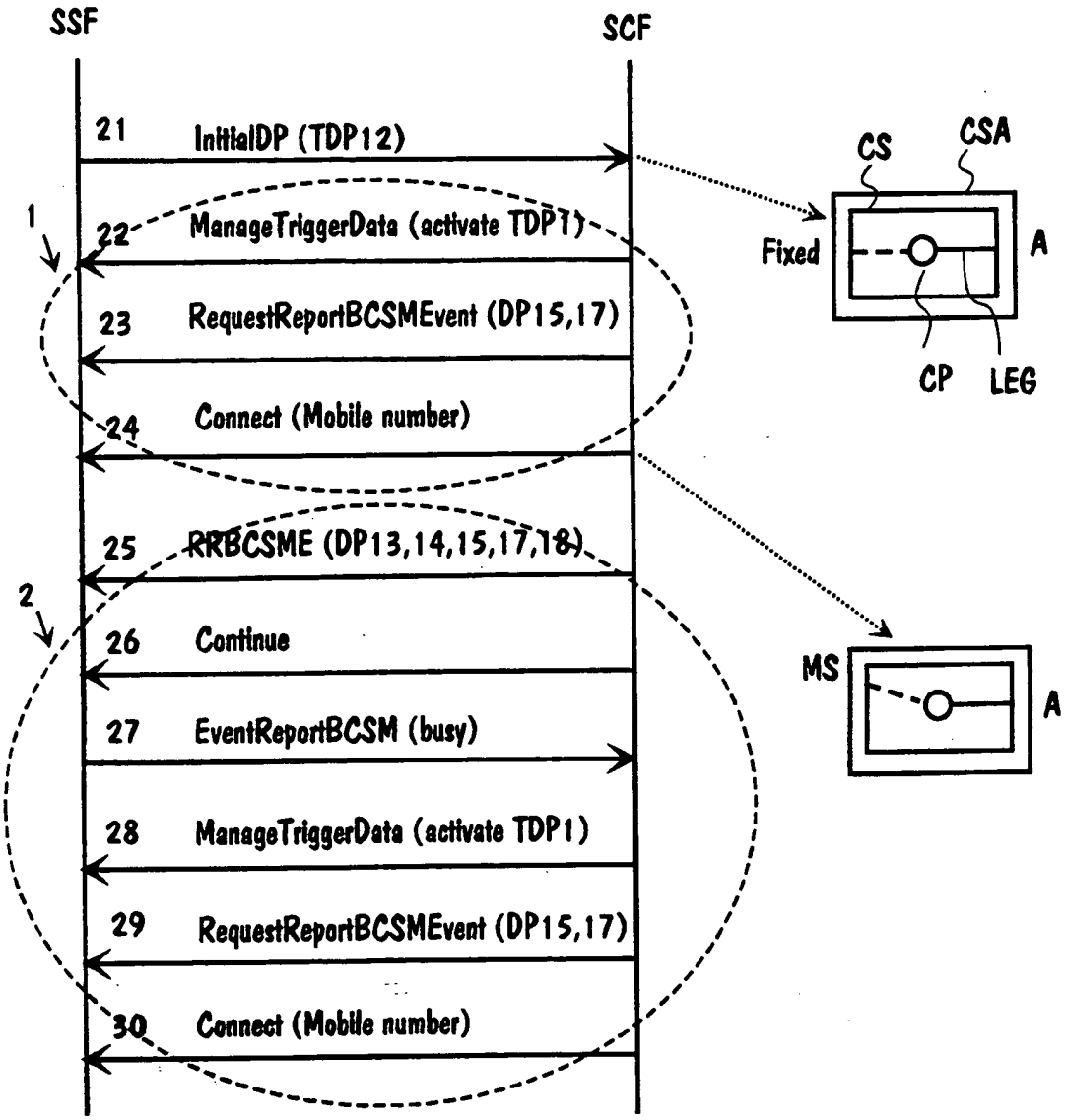

SSF
SCF
21 InitialDP (TDP12)
1
22 ManageTriggerData (activate TDP1)
23 RequestReportBCSMEvent (DP15,17)
24 Connect (Mobile number)
25 RRBCSME (DP13,14,15,17,18)
2
26 Continue
27 EventReportBCSM (busy)
28 ManageTriggerData (activate TDP1)
29 RequestReportBCSMEvent (DP15,17)
30 Connect (Mobile number)
CS
CSA
Fixed
A
CP
LEG
MS
A

FIGURE 2

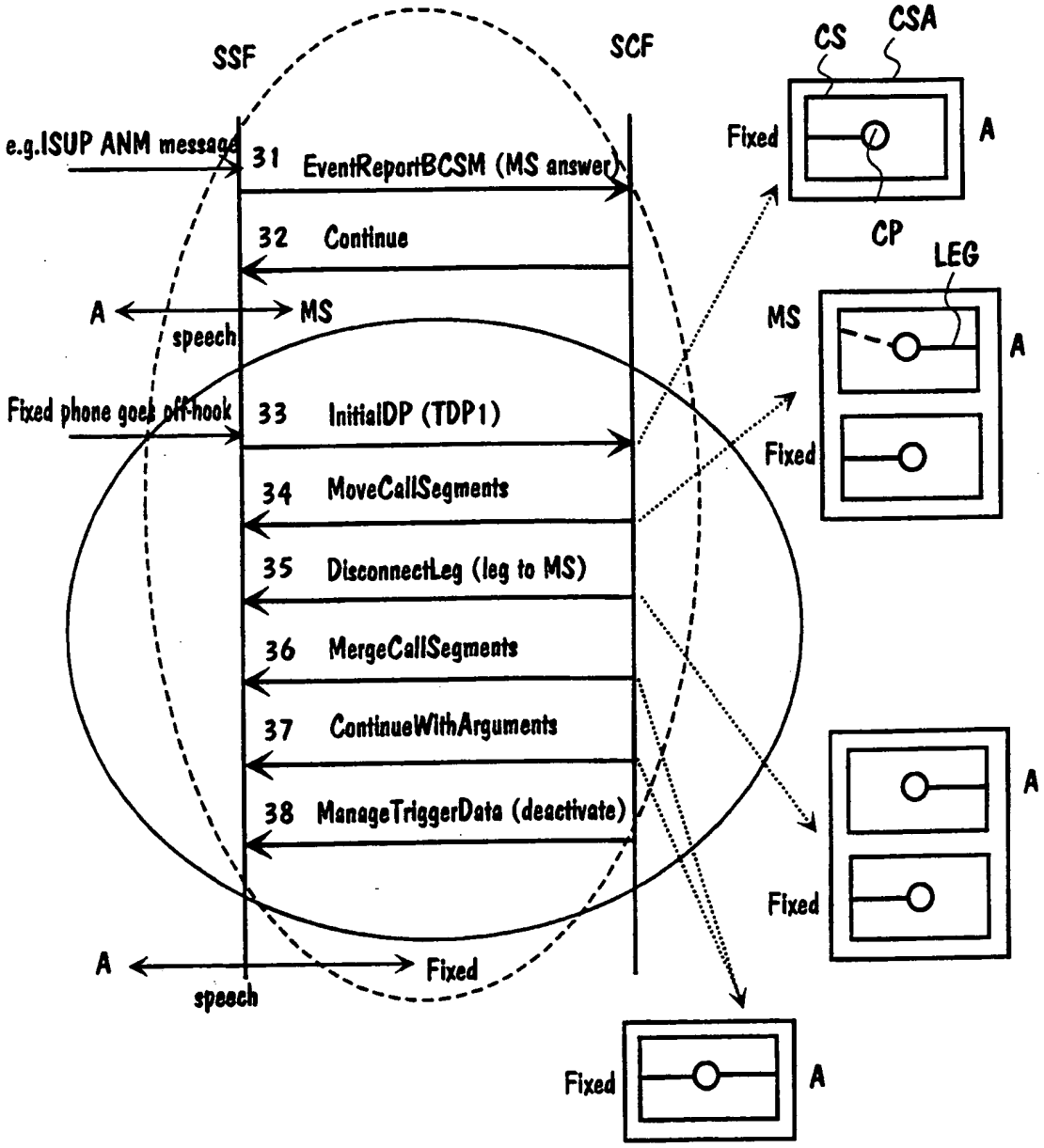

SSF
SCF
CS
CSA
Fixed
A
e.g.ISUP ANM message
31 EventReportBCSM (MS answer)
32 Continue
CP
LEG
A
MS
speech
MS
A
Fixed phone goes off-hook
33 InitialDP (TDP1)
Fixed
34 MoveCallSegments
35 DisconnectLeg (leg to MS)
36 MergeCallSegments
37 ContinueWithArguments
38 ManageTriggerData (deactivate)
A
Fixed
A
Fixed
speech
Fixed
A

FIGURE 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 00/00024

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04M 3/54
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5502762 A (BRIAN J. ANDREW ET AL), 26 March 1996 (26.03.96), column 2, line 3 - line 33	1-10
X	US 5471519 A (WAYNE HOWE ET AL), 28 November 1995 (28.11.95), column 9, line 44 - line 59; column 12, line 50 - line 63	1-2
A	WO 98/21900 A1 (TELEFONAKTIEBOLAGET LM ERICSSON (PUBL)), 22 May 1998 (22.05.98), abstract	1-10
A	US 5818919 A (EDWARD CHARLES BERBERICH, JR. ET AL), 6 October 1998 (06.10.98), abstract	1-10

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
5 July 2000	12 -07- 2000
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Tomas Erlandsson/EE Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI00/00024

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).:

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

See extra sheet.

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☒ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

Box II

The claimed invention relates to a method for call forwarding in a telecommunications network.

In the method according to independent claim 1, a call from a first subscriber to a second subscriber's first terminal equipment is forwarded to a second terminal equipment via an intelligent network. A system monitors whether the second subscriber carries out a predetermined action on the first terminal equipment while a mobile telephone (possibly the second terminal equipment) is ringing. If that action is detected, the call is re-routed to the first equipment.

In US 5502762 A, a method for forwarding a call to, for example, a mobile telephone is disclosed. According to this method a first telephone is called and then a conference call facility dials the second telephone, which may be a mobile telephone, while maintaining the contact with the first telephone. At the following stage both telephones are ringing. If someone picks up the receiver of the first telephone, the call is connected to that telephone and the conference bridge is dropped.

The only difference between the method of claim 1 and the method disclosed in US 5502762 A is that an intelligent network is used instead of a conference call facility. It must be considered obvious for a person skilled in the art to use an intelligent network for forwarding a call. Consequently, the method of claim 1 is not considered to involve an inventive step.

Invention I: Claim 2 relates to a pre-defined action on the first terminal equipment.

Invention II: Claim 3 relates to how the monitoring is started.

Invention III: Claims 4-9 relate to how the monitoring is ended.

Invention IV: Claim 10 relates to how call forwarding and returning the call to the original number is implemented.

The only common special technical feature of inventions I-IV is a method according to claim 1. Since this feature does not avoid prior art, inventions I-IV, a posteriori, do not satisfy the requirement of unity of invention.

INTERNATIONAL SEARCH REPORT

Information on patent family members

02/12/99

International application No.
PCT/FI 00/00024

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5502762 A	26/03/96	CA 2150842 A	11/12/95
US 5471519 A	28/11/95	NONE	
WO 98/21900 A1	22/05/98	NONE	
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